
# IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

**Patent Application**

| | | | |
|---|---|---|---|
| **Inventor(s)** | Turan Erdogan<br>Thomas Andrew Strasser<br>Paul Stephen Westbrook | | |
| **Case** | 12-42-7 | **Conf. No.** | 5151 |
| **Serial No.** | 09/781,857 | **Group Art Unit** | 2633 |
| **Filing Date** | February 12, 2001 | | |
| **Examiner** | Shi K. Li | | |
| **Title** | **In-Line Polarization Monitoring and Control in Lightwave Communication Systems** | | |



**COMMISSIONER FOR PATENTS**
**ALEXANDRIA, VA 22313**

**SIR:**

## BRIEF ON APPEAL

## I. INTRODUCTION

Appellants submit the foregoing Brief pursuant to a Notice of Appeal filed June 19, 2004, from a decision of the Examiner dated June 15, 2004, finally rejecting pending claims 8, 11-14, 17 and 18.

## II. REAL PARTY IN INTEREST

OFS Fitel is the real party in interest by virtue of an Assignment from Lucent Technologies, Inc. to OFS Fitel dated November 8, 2001.

## III. RELATED APPEALS AND INTERFERENCES

This is the first appeal in the above-identified application.

## IV. STATUS OF CLAIMS

The present application contains claims 8-18 (claims 1-7 having been previously cancelled), where claims 8, 11-14, 17 and 18 stand finally rejected. Remaining claims 9, 10, 15 and 16 stand as objected to by the Examiner as pending from a rejected base claim. The attached Appendix A contains a complete, clean copy of the claims now pending in the application.

Appellants appeal the Final Rejection by the Examiner of claims 8, 11-14, 17 and 18, and affirm the patentability of claims 9, 10, 15 and 16.

## V. STATUS OF AMENDMENTS

In the Advisory Action dated June 5, 2004 (application Paper No. 11), the Examiner stated that the proposed amendment of May 18, 2004 would be entered, but was not found to place the case in condition for allowance.

## VI. SUMMARY OF THE INVENTION

Appellants' invention, as discussed in the specification at page 3, beginning at line 16, "relates to polarization monitoring and control in lightwave communication systems and, more particularly, to the use of an in-line, compact polarimeter to provide polarization monitoring and control in various system arrangements. In accordance with the present invention, an in-line polarimeter is sued that is capable of directly measuring the polarization in the transmission fiber within a communication system. In one embodiment, the in-line polarimeter is sued in conjunction with an polarization

controlling element to form an "active polarization controller". In this case, the output from the in-line polarimeter is sued as a feedback signal to the polarization controller..an in-line polarimeter [of the present invention] can be utilized to fully characterize the state of polarization of an optical signal (by making four separate measurements on the fiber) or, in contrast, provide partial information regarding the state of polarization by making, for example, two measurements of the signal polarization (wherein this information may be used in situations using birefringent fiber)."

Independent claims 8 and 11 define an "active polarization control arrangement" that includes "a polarization control element ... comprising a correction signal input", an "in-line fiber polarimeter formed...at the output of the polarization control element"; and "a feedback control element .... For providing correction signals to the poilarization control element based on the out-coupled signals from the in-line polarimeter".

## VII. ISSUES

The issues on appeal are: (1) whether the subject matter of claims 8, 11, 13 and 18 is rendered obvious under 35 USC 103(a) by US Patent 6,567,167 (Chou et al.), in view of US Patent 5,815,270 (Lee et al.), or US Patent 5,440,390 ( Tirri et al), or US Patent 5,296,913 to Henner; (2) whether claim 12 is rendered obvious under 35 USC 103(a) by Chou et al. (as above), in further view of US Patent 6,385,356 (Jopson et al.); and (3) whether the subject matter of claims 14 and 17 is rendered obvious under 35 USC 103(a) by Chou et al. in view of Lee, Tirri or Heffner (as applied to claim 11), in further view of US Patent 6,208,442 (Liu et al.).

Appellants request that the Board of Patent Appeals and Interferences reverse the decision of the Examiner finally rejecting these claims and find claims 8, 11-14, 17 and 18 to be in condition for allowance over all of the cited references, whether singly or in any combination.

## VIII. GROUPING OF CLAIMS

For the purposes of this Appeal, claim 8 stands separately, and claims 11-14 and 17 stand or fall together.

## IX. ARGUMENTS

### *A. 35 USC § 103(a) Rejection - Claims 8, 11, 13 and 18*

In the Office action dated March 19, 2004 (application Paper No. 9), the Examiner issued a Final Rejection of the cited claims under 35 USC 103(a) as being unpatentable over Chou et al. in view of Lee, Tirri or Heffner.

In the rejection, the Examiner cited Chou et al. as teaching all of the "system" aspects of the present invention, except for the provision of an "in-line *fiber*" polarimeter. In particular, the Examiner cited Chou et al. as teaching a feedback control element (120 or 220), an in-line polarimeter (210), control signal output (215), adjustable input (130) and a polarization control element (170). In response to this rejection, appellants asserted that Chou et al. does not teach or disclose "the use of a feedback path in a 'polarization controller'" (response dated May 18, 2004). In the Advisory Action dated June 15, 2004, the Examiner disagreed with this conclusion and stated that "[t]he delay controller of Chou et al. is equivalent to the APC of the claims. The delay controller changes the relative delay between the two principal states of polarization and produces an optical signal exhibiting a predetermined state of polarization. As illustrated in FIG. 1, Chou et al. teaches to use a feedback configuration consisting of delay module 170, polarimeter 210 and control circuit 220".

In response, appellants respectfully assert that the "control" as illustrated and discussed in Chou et al. is to introduce a predetermined delay with respect to phase (that is, a time delay is introduced between the two principle states of polarization. The polarization states themselves remain intact. There is no "control" of the polarization

state of the signal in Chou et al. Referring to Chou et al., the "polarization control" in this apparatus occurs within element 108. Referring to Chou et al. at column 3, beginning at line 48, "[c]omputer 120 uses the electronic signals in an algorithm stored in the computer's CPU to determine the principal states of polarization (PSPs) of optical fiber 22 and sends control signals to modify the settings of a first retarder 140 and a second retarder 150 in polarization transformer 108 ... such that light exiting polarization controller 100 is linearly polarized and aligned to the x- and y-axis of delay controller 200". Thus, all "polarization" operations occur within polarization controller 100. Element 200 - the "delay controller" is the only element that contains feedback, from polarimeter 210, through control circuit 220 back to delay module 170. And this controller is the time/delay shifting portion of the circuit. The Examiner is correct in stating that the "delay controller changes the relative delay between the two principal states of polarization", but the states themselves remain the same.

In contrast, the subject matter of the present invention, as defined by rejected claims 8, 11, 13 and 18 is directed to an "*active* polarization control arrangement" including a "polarization control element" that utilizes a control signal from the "feedback control element" for "producing as an output an optical signal exhibiting a predetermined state of polarization". Appellants assert that the teachings of phase correction in Chou et al. cannot be equated with polarization correction as defined by the rejected claims. In light of this lack of teaching by Chou et al., appellants assert that the combination of Chou et al. with any one of Lee, Tirri or Heffner cannot be found to render obvious the subject matter of the present invention as defined by claims 8, 11, 13 and 18. Appellants therefore respectfully request the Board of Appeals to reconsider these arguments, reverse the Examiner's rejection and find claims 8, 11, 13 and 18 to be in condition for allowance.

***B. 35 USC § 103(a) Rejection - Claim 12***

In the next rejection, the Examiner cited claim 12 under 35 USC 103(a) as being unpatentable over Chou et al. (as above), in further view of US Patent 6,385,356 (Jopson et al.). In the rejection, the Examiner cited Jopson et al. as teaching the use of a section of birefringent fiber in association with a polarization controller. The Examiner then

concluded that it would be obvious to include a section of birefringent fiber in Chou et al. to arrive at the subject matter of claim 12.

Appellants, in response, continue to assert that Chou et al. does not disclose the configuration or use of an "active" polarization controller that utilizes feedback to modify the polarization state of the signal propagating along the fiber, as defined by independent claim 11, from which claim 12 depends. Without this teaching appellants believe that the combination of Jopson et al. with Chou et al, Lee et al., Tirri or Hefner cannot be found to render obvious the subject matter of claim 12.

Therefore, appellants respectfully request the Board of Appeals to review these assertions and overturn the Examiner's rejection of claim 12.

***C. 35 USC § 103(a) Rejection - Claims 14 and 17***

Claims 14 and 17 were rejected by the Examiner as unpatentable over Chou et al. in view of Lee et al., Tirri or Heffner, as applied to claim 11, in further view of US Patent 6,208,442 (Liu et al.), where Liu et al. was cited by the Examiner as teaching the use of wavelength filters (regarding claim 14). The combination of Liu et al. with the remaining cited references, however, does not disclose or suggest the use of a feedback path to control the polarization state of the optical signal, the Chou et al. reference directed to using feedback to control the phase delay (time shift) between the two, fixed polarization states. The Examiner also cites Chou as teaching the use of a "first arrangement" (100) disposed at an optical transmitter and a "second arrangement" (200) disposed at an optical receiver, thereby rendering obvious the subject matter of claim 17.

In response, appellants assert that elements 100 and 200 of Chou et al. are not "first" and "second" arrangements of the same element - module 100 of Chou et al. is a "polarization controller" and module 200 of Chou et al. is a "delay controller". Further, appellants assert that arrangement 100 is not disposed at the optical transmitter 15. Referring to FIG. 1 of Chou et al., a section of fiber 22, denoting the transmission fiber is illustrated as coupled transmitter 15 (via polarization modulator 20) to polarization controller 100. As discussed in Chou et al. at column 3, elements 100 and 200 together form "compensating apparatus" that is disposed at an optical receiver ("places between an output 21 of an optical fiber 22 and an input 235 of optical receiver 240").

In contrast, claim 17 defines the use of "active polarization control" at both an optical transmitter input module and an optical receive output module.

Based on these differences between the cited combination of references and pending claims 14 and 17, appellants believe that both claims are patentable over these references and respectfully request the Board of Appeals to review the Examiner's issuance of a Final Rejection, reverse the Examiner's decision, and allow these claims to issue.

## X. CONCLUSION

The present application contains claims 8-18. Claims 1-7 have previously been cancelled. Claims 9, 10, 15 and 16 have been previously cited by the Examiner as containing patentable subject matter. For the reasons expressed above, appellants believe that the Examiner's rejection of remaining claims 8, 11-14, 17 and 18 under 35 USC § 103(a) are considered to lack merit and thus mandates reversal. Appellants solicit such action from the Board of Appeals at this time.

Respectfully submitted,

Turan Erdogan
Thomas Andrew Strasser
Paul Stephen Westbrook

By: Wendy W. Koba
Wendy W. Koba
Reg. No. 30509
Attorney for appellants
610-346-7112

Date: 8/17/04

**Appendix A - Pending Claims for Application No. 09/781,857**

**1. - 7.** ***cancelled***

**8.** *(previously presented)* An active polarization control arrangement for use in an optical transmission system, the active polarization control arrangement comprising

a polarization control element responsive to an input optical signal propagating along an optical fiber transmission path and further comprising a correction signal input, the polarization control element for producing as an output an optical signal exhibiting a predetermined state of polarization;

an in-line fiber polarimeter formed as an integral part of the optical fiber transmission path at the output of the polarization control element and configured to out-couple signals determined by the state of polarization of the input optical signal; and

a feedback control element responsive to the out-coupled signals from the in-line fiber polarimeter, said feedback control element for providing correction signal inputs to the polarization control element based on the out-coupled signals from the in-line polarimeter.

**9.** *(previously presented)* An active polarization control arrangement as defined in claim 8 wherein the in-line fiber polarimeter is defined as a complete in-line fiber polarimeter and comprises a set of four fiber gratings incorporated in the optical fiber transmission path, each set tilted at one of the predetermined angles of 0°, 60°, 150°, and 90°, with a waveplate oriented at an angle of 30° with respect to the optical axis disposed between the second and third fiber gratings.

**10.** *(previously presented)* An active polarization control arrangement as defined in claim 8 wherein the in-line fiber polarimeter is defined as a complete in-line fiber polarimeter and includes a set of four dielectric filters, each filter tilted at one of the predetermined angles of 0°, 60°, 150°, and 90°, with a waveplate oriented at an angle of 30° with respect to the optical axis disposed between the second and third filter.

**11.** *(previously presented)* An optical transmission system comprising a transmitter for providing one or more optical input signals, an optical fiber transmission path and an optical receiver, said optical transmission system further comprising

at least one active polarization control arrangement, each active polarization control arrangement including

a polarization control element responsive to one or more input optical signals propagating along the optical fiber transmission path and further comprising a correction signal input, the polarization control element for producing as an output an optical signal exhibiting a predetermined state of polarization;

an in-line fiber polarimeter integral with said optical fiber transmission path at the output of the polarization control element and configured to out-couple signals determined by the state of polarization of the input optical signal; and

a feedback control element disposed in a feedback loop between the in-line fiber polarimeter and the polarization control element, said feedback control element responsive to the out-coupled signals from the in-line fiber polarimeter for providing the correction signal inputs to the polarization control element based on the out-coupled signals from the in-line fiber polarimeter.

**12.** *(previously presented)* An optical transmission system as defined in claim 11 wherein the optical fiber transmission path comprises at least a section of birefringent fiber and the active polarization control arrangement is used to orient the polarization axes of the optical output from the in-line fiber polarimeter with the optical axes of the birefringent transmission path optical fiber.

**13.** *(previously presented)* An optical transmission system as defined in claim 11 wherein the transmission system further comprises a polarization beam splitter, disposed at the output of the in-line fiber polarimeter, the polarization control element utilized to adjust the output signal state of polarization to align with one of the beamsplitter principal axes.

**14.** *(previously presented)* An optical transmission system as defined in claim 13 wherein the transmission system further comprises wavelength filters disposed at each output of the polarization beam splitter to discriminate between two orthogonal channels with closely spaced wavelengths.

**15.** *(previously presented)* The optical transmission system as defined in claim 11 wherein the in-line fiber polarimeter of the active polarization control arrangement is a complete polarimeter and comprises a set of four fiber gratings incorporated in optical fiber, each set tilted at one of the predetermined angles of 0°, 60°, 150°, and 90°, with a waveplate oriented at an angle of 30° with respect to the optical axis disposed between the second and third gratings.

**16.** *(previously presented)* The optical transmission system as defined in claim 11 wherein the in-line fiber polarimeter of the active polarization control arrangement comprises a complete polarimeter and includes a set of four dielectric filters, each filter tilted at one of the predetermined angles of 0°, 60°, 150°, and 90°, with a waveplate oriented at an angle of 30° with respect to the optical axis disposed between the second and third filters.

**17.** *(previously presented)* The optical transmission system as defined in claim 14 wherein the at least one active polarization control arrangement comprises a first arrangement disposed at an optical transmitter and a second arrangement disposed at an optical receiver.

**18.** *(previously presented)* The optical transmission system as defined in claim 11 wherein the at least one active polarization control arrangement comprises an in-line fiber polarimeter located at the optical receiver and the polarization controller located at the optical transmitter, using a telemetry channel to transmit feedback information from the in-line fiber polarimeter to the polarization controller.